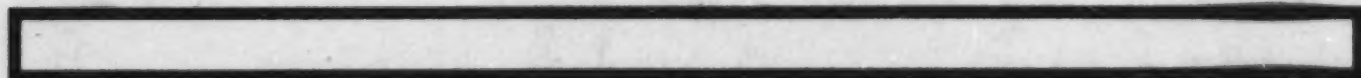


Chromosome Complement of the Marine Worm
'Neanthes arenaceodentata'
(Polychaeta: Annelida)

(U.S.) Environmental Research Lab.
Narragansett, RI

31 Oct 79



U.S. Department of Commerce
National Technical Information Service

NTIS.

TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)		
1. REPORT NO. EPA-600/J-80-321	2. <i>journal article #163</i>	3. RECIPIENT'S ACCESSION NO. P881 233405
4. TITLE AND SUBTITLE Chromosome complement of the marine worm <i>Neanthes arenaceodentata</i> (Polychaeta: Annelida)		5. REPORT DATE 1980 (issue date)
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Gerald G. Pesch and Carol E. Pesch		8. PERFORMING ORGANIZATION REPORT NO. ERLN-J128
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Environmental Protection Agency Environmental Research Laboratory Narragansett, RI 02882		10. PROGRAM ELEMENT NO. ACHH1A
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS same as above		13. TYPE OF REPORT AND PERIOD COVERED journal article
		14. SPONSORING AGENCY CODE EPA/600/05
15. SUPPLEMENTARY NOTES REFERENCE: CANADIAN JOURNAL OF FISHERIES AND AQUATIC SCIENCES, 37(2): 286-288, 1980		
16. ABSTRACT The chromosome complement for the marine worm <i>Neanthes arenaceodentata</i> consists of nine pairs; one pair has a median centromere, seven pairs have submedian centromeres, and one pair is polymorphic with either a subterminal or terminal centromere. A technique for studying polychaete chromosomes is described. This species was selected as a model for studying cytogenetic effects of toxicants in marine environments because it has a suitable karyotype, is easily cultured, and as a benthic organism it is representative of an ecologically important group of organisms.		
17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS chromosomes, karyotype, polychaete, <i>Neanthes arenacendentata</i>	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
19. DISTRIBUTION STATEMENT release unlimited		19. SECURITY CLASS (This Report) 21. NO. OF PAGES 3
		20. SECURITY CLASS (This page) 22. PRICE

EPA-600/J-80-321
Journal Article

Reprinted from

Réimpression du

PB81-233405

Canadian
Journal
of Fisheries
and Aquatic
Sciences

Journal
canadien
des sciences
halieutiques
et aquatiques

Chromosome Complement of the Marine Worm
Neanthes arenaceodentata (Polychaeta: Annelida)

GERALD G. PESCH AND CAROL E. PESCH

Volume 37 • Number 2 • 1980

Pages 286-288

PRODUCT OF:
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

Government of Canada
Fisheries and Oceans

Gouvernement du Canada
Pêches et Océans

Chromosome Complement of the Marine Worm *Neanthes arenaceodentata* (Polychaeta: Annelida)

GERALD G. PESCH AND CAROL E. PESCH

U.S. Environmental Protection Agency, Environmental Research Laboratory, Narragansett, RI 02882, USA

PESCH, G. G., AND C. E. PESCH. 1980. Chromosome complement of the marine worm *Neanthes arenaceodentata* (Polychaeta: Annelida). Can. J. Fish. Aquat. Sci. 37: 286-288.

The chromosome complement for the marine worm *Neanthes arenaceodentata* consists of nine pairs; one pair has a median centromere, seven pairs have submedian centromeres, and one pair is polymorphic with either a subterminal or terminal centromere. A technique for studying polychaete chromosomes is described. This species was selected as a model for studying cytogenetic effects of toxicants in marine environments because it has a suitable karyotype, is easily cultured, and as a benthic organism it is representative of an ecologically important group of organisms.

Key words: polychaete, chromosomes, karyotype

PESCH, G. G., AND C. E. PESCH. 1980. Chromosome complement of the marine worm *Neanthes arenaceodentata* (Polychaeta: Annelida). Can. J. Fish. Aquat. Sci. 37: 286-288.

Le complément chromosomique du ver marin *Neanthes arenaceodentata* est formé de neuf paires; une paire possède un centromère médian, sept paires des centromères submédiens, et une paire est polymorphe avec centromère soit subterminal, soit terminal. Nous décrivons une méthode d'étude des chromosomes des polychètes. Cette espèce a été choisie comme modèle d'étude des effets cytogénétiques de toxiques en milieux marins, parce qu'elle possède un caryotype approprié, s'élève facilement et, comme organisme benthique, est représentative d'un groupe d'organismes écologiquement importants.

Received July 30, 1979
Accepted October 31, 1979

Reçu le 30 juillet 1979
Accepté le 31 octobre 1979

ALTHOUGH the family Nereidae occurs worldwide and includes 439 species within 37 genera (Fauchald 1977) little information exists relative to cytogenetic properties. Bonnevie (1907) reported a diploid chromosome number of 20-30 for the species *Nereis limbata* and Just (1915) found a haploid chromosome number of 14 for *Platynereis megalops*. Nearly 50 yr later, Ometz (1963) determined a diploid chromosome number of 32 for *Nereis diversicolor*, 34 for *Perinereis cultrifera*, and Davis (1969) reported a diploid chromosome number of 18 for *Neanthes arenaceodentata*. However, none of the authors presented karyotypes.

This note contains details of the cytological technique employed for obtaining a karyotype and a de-

scription of the chromosome complement of *Neanthes arenaceodentata* from somatic cells arrested at metaphase.

Materials and methods—The test animals (*Neanthes arenaceodentata*, Moore) were from laboratory cultures originally obtained from Dr Donald Reish at California State University, Long Beach. *Neanthes arenaceodentata* construct mucous tubes in sediment or on firm surfaces such as algal mats or mussel beds. Females deposit eggs within the mucous tubes, then die. Males then incubate the eggs and the larvae develop within the tubes.

Larvae are removed from the tubes after 8-10 d with a siliconized Pasteur pipette and treated with 0.05% colchicine in a polyethylene beaker containing 100 mL of 30% filtered seawater for approximately 12 h at room temperature. The following procedure for slide preparation is adapted from Kligerman and Bloom (1977). Seawater is

Printed in Canada (J5729)
Imprimé au Canada (J5729)

decanted and replaced with 100 mL of 0.075 mol/L solution of potassium chloride for 1 h, followed by larval fixation in three changes of ethanol-acetic acid (3:1) for 1 h each. Fixed larvae (25–30) are then placed on a clean slide and enough 50% acetic acid added to cover all of the larvae (several drops). After 4 min the acid is drained off and the larvae are smeared by pressing a second slide on top of the first and then drawing the two slides apart with one smooth continuous movement. This produces a monolayer of separated cells on each slide, which are air dried and stained for 5 min in 5% Giemsa made up in deionized water. These slides are rinsed thoroughly in deionized water, air dried, dipped in xylene, and mounted in coverbond. Photographs were taken with Kodak 35-mm high contrast copy film using a Zeiss Universal scope, 100× planapochromatic objective, 1.6× optovar, and 10× ocular.

Results and discussion—A diploid chromosome number of 18 was observed in cells arrested in metaphase in 25 different worms. This agreed with the observation of Davis (1969). A representative karyotype for *N. arenaceodentata* is shown in Fig. 1. The chromosomes range in size from 4 to 7 μ m, and can be grouped into two size categories. One group consisting of pairs, No. 1–5, measure from approximately 6 to 7 μ m and the other group, No. 6–9, measure from approximately 4 to 5 μ m. The chromosomes are described according to the terminology of Levan et al.



FIG. 1. Chromosomes of *Neanthes arenaceodentata* numbered from largest to smallest.

TABLE 1. Length and centromere position of *Neanthes arenaceodentata* chromosomes.

Chromosome number	Length (μ m)	Arm ratio*	Centromere location*
1	6.7	1.56	median region
2	6.1	1.84	submedian region
3	6.0	2.20	submedian region
4	5.8	2.15	submedian region
5	5.7	2.89	submedian region
6	4.9	2.93	submedian region
7	4.6	2.72	submedian region
8	4.2	2.40	submedian region
9A	3.6		terminal point
9B	4.5	3.67	subterminal region

*According to Levan et al. (1964).

(1964). The centromere of the largest chromosome, No. 1, is located in the median region. Chromosomes No. 2–8 have centromeres located in the submedian region (Table 1). The shortest chromosome, No. 9, appears in two forms (Fig. 1). One form has a short second arm with centromere in the subterminal region; the second form appears to have a terminally located centromere. The shortest chromosome pair of individual worms consisted of either a combination of one of each type or both with terminal centromeres. We have never observed short pairs where both chromosomes contained subterminal centromeres. We do not know the significance of the differences observed in this chromosome pair.

Neanthes arenaceodentata was chosen as a model to study cytogenetic effects of toxicants in marine environments because it has a suitable karyotype (18 large chromosomes) and is easily cultured, thus providing a continuous supply of experimental material. This species has many attributes which make it valuable to assess effects of pollutants. Because *N. arenaceodentata* is a benthic species, it is of particular interest because sediments are often reservoirs for pollutants and polychaetes are important food web species for commercially important fishes. Consequently, this species is widely used in marine toxicological studies (Reish et al 1976; Oshida et al. 1976; Rossi and Anderson 1976, 1977; Neff et al. 1978; Pesch 1979). We are presently developing a short term, cytogenetic assay technique, sister chromatid exchange responses (SCE), for *N. arenaceodentata*. Because an SCE assay may be conducted in vivo, it may be possible to relate cytogenetic observations to subsequent biological consequences inflicted by genetic toxicants at the individual and population levels.

BONNEVILLE, K. 1907. Heterotypical mitosis in *Nereis limbata* (Ehlers). Biol. Bull. 13: 57–83.

DAVIS, W. 1969. Oogenesis and its relationship to dissolved oxygen suppression in *Neanthes arenaceodentata* (Polychaeta: Annelida). M.S. Thesis, California State Univ., Long Beach, Calif. 62 p.

- FAUCHALD, K. 1977. The polychaete worms, definitions and keys to the orders, families and genera. Nat. Hist. Mus. Los Angeles. Sci. Ser. 28: 188 p.
- JUST, E. E. 1915. The morphology of normal fertilization in *Platynereis megalops*. J. Morphol. 26: 217-233.
- KLIGERMAN, A. D., AND S. E. BLOOM. 1977. Rapid chromosome preparations from solid tissues of fishes. J. Fish. Res. Board Can. 34: 266-269.
- LEVAN, A., K. FREDRA, AND A. A. SANDBERG. 1964. Nomenclature for centromeric position on chromosomes. Hereditas 52: 201-220.
- NEFF, J. W., R. S. FOSTER, AND J. F. SLOWEY. 1978. Availability of sediment-adsorbed heavy metals to benthos with particular emphasis on deposit-feeding infauna. Washington, D.C., Chief Eng. U.S. Army Tech. Rep. D-78-42: 286 p.
- OMETZ, S. 1963. Données caryologiques sur deux espèces de néreidiens: *Perinereis cultrifera* Grube et *Nereis diversicolor* O. F. Müller (Annélides: Polychètes). C. R. Soc. Biol. Paris 157: 813-814.
- OSHIDA, P., A. J. MEARNS, D. J. REISH, AND C. S. WORD. 1976. The effects of hexavalent and trivalent chromium on *Neanthes arenaceodentata* (Polychaeta: Annelida). Southern California Coastal Water Research Project. 1500 East Imperial Highway, El Segundo, California 90245, 58 p.
- PESCH, C. E. 1979. Influence of three sediment types on copper toxicity to the polychaete *Neanthes arenaceodentata*. Mar. Biol. 52: 237-245.
- REISH, D. J., J. M. MARTIN, F. M. PILTZ, AND J. Q. WORD. 1976. The effect of heavy metals on laboratory populations of two polychaetes with comparisons to the water quality conditions and standards in southern California marine waters. Water Res. 10: 299-302.
- ROSSI, S. S., AND J. W. ANDERSON. 1976. Toxicity of water-soluble fractions of No. 2 fuel oil and South Louisiana crude oil to selected stages in the life history of the polychaete *Neanthes arenaceodentata*. Bull. Environ. Contam. Tox. 16(1): 18-24.
1977. Accumulation and release of fuel-oil-derived diaromatic hydrocarbons by the polychaete *Neanthes arenaceodentata*. Mar. Biol. 39: 51-55.